

# Speed, Agility, and Quickness (SAQ) training of the circuit system: How does it affect kick speed and agility of junior taekwondo athletes?

Imran Akhmad\* , Tarsyad Nugraha , Petrus Sembiring 

Universitas Negeri Medan, Indonesia

Received: 16 February 2021; Accepted 10 May 2021; Published 21 July 2021

Ed 2021; 6(2): 175-182

## ABSTRACT

The study is conducted based on a trainer's difficulty in improving the speed of kicks and agility of taekwondo junior athletes. This condition is a consideration for trainers to develop a proper and measurable circuit SAQ training program to improve kick speed and agility for taekwondo novice athletes. This study aims to find out the effect of SAQ circuit exercises with kick speed and agility. The research method used is an experimental method with equivalent time series design research design. The research is conducted for 6 weeks with a frequency of 1 week 3 exercises and consists of 3 series. Every 4 weeks it is done posttest with design; (1) pre-test-treatment-posttest stage 1, and (2) pre test-posttest-posttest stage 2. Data analysis technique uses t test with significance level 0.05. The results conclude that; (1) there is a significant influence between circuit SAQ exercises on the kick speed of taekwondo junior athletes. (2) there is a significant influence between circuit SAQ exercises on the agility of taekwondo junior athletes. From the results of this study, researchers expect that there will be recommendations to be used as further considerations for the future so that this study is more in-depth related to SAQ exercises, and hopefully this study can be a reference material for other researchers who want to research about the influence of SAQ exercises.

**Aywords:** SAQ; speed kick; agility; taekwondo



[https://doi.org/10.25299/sportarea.2021.vol6\(2\).6433](https://doi.org/10.25299/sportarea.2021.vol6(2).6433)

OPEN  ACCESS



Copyright © 2021 Imran Akhmad, Tarsyad Nugraha, Petrus Sembiring

**Corresponding author:** Imran Akhmad, Department of Sport Coaching, Faculty of Sport Science, Universitas Negeri Medan, Medan, Indonesia

Email: [imran@unimed.ac.id](mailto:imran@unimed.ac.id)

**How to Cite:** Akhmad, I., Nugraha, T., & Sembiring P. (2021) Speed, Agility, and Quickness (SAQ) training of the circuit system: How does it affect kick speed and agility of junior taekwondo athletes?. *Journal Sport Area*, 6(2), 175-182. [https://doi.org/10.25299/sportarea.2021.vol6\(2\).6433](https://doi.org/10.25299/sportarea.2021.vol6(2).6433)

## INTRODUCTION

Taekwondo is a branch of martial arts in general which aims for self-defense, fitness, and achievement. As with other martial arts branches, taekwondo requires good biomotor elements (Akhmad, 2013). When it is viewed from the characteristics of the fast and accurate movement and changes position quickly which is shown by hitting, kicking, and dodging techniques simultaneously. So the sport of self-defense requires several elements of excellent physical components such as; endurance, strength, speed, coordination, and flexibility (Bompa & Haff, 2009). Endurance is used to maintain conditions in order to remain physically fit during the match. Strength is needed to perform powerful punches and kicks so as to allow the opponent to be knocked out. Speed is useful for preparing physically to hit, kick, and dodge quickly so that the opponent has difficulty attacking. Coordination is useful for combining attacking, parrying, kicking and dodging

movements, and blending into one complete movement. Moderate flexibility is useful for getting a wide range of motion and avoiding injury (Baechle & Earle, 2000).

Specifically, the sport of taekwondo really needs movement speed because the faster someone kicks, the easier it is to find points in competing (Fong et al., 2013). Movement speed is useful for attacking, dodging and responding to stimuli so that it requires agility and quickness components. Meanwhile, to get agility and quickness, speed is needed (Brown, & Ferrigno, 2005). The three variables both mean speed but have different characteristics. Velocity relates to the displacement of the body as a whole in a straight line. Agility means changing the direction and position of the body quickly. Quickness is meant by the speed of generating responses to external stimuli (Brown & Ferrigno, 2014). In the training process these three variables can be made into a single unit and are called Speed, Agility, and Quickness (SAQ) (Nageswaran, 2013).

In taekwondo speed there are 2 important components in the context of speed, namely; kick speed and agility (Sabatini, Nugraha, & Dewi, 2019). The speed of taekwondo kicks is largely determined by the movement of the thigh/leg that is carried out quickly and relatively briefly against the target. A Taekwondo athlete must have high speed so that when the stimulus comes, in the shortest possible time he releases a kick/attack to a predetermined target. But apparently, kicking speed and agility are difficult for junior athletes (Jeong et al., 2021).

Based on observations made by researchers at several matches in North Sumatra, almost 70 percent of the scores achieved by athletes were kicking reaction speed. At the 2019 North Sumatran Open Komando Cup held in Medan, from the 16 classes that were competed for the first place men, 3 people had good kick reaction speed, and for the women's first place, 1 person, the rest (12 people) had bad reaction speed. The next observation at the Regional Student Sports Week in Medan, some athletes who represent North Sumatra still do not have a good kick reaction speed. Obviously this is an obstacle in achieving victory.

In order to support observations in the match, interviews are then conducted with several coaches (21 coaches) about the implementation of the training process. From the results of the interview, it can be concluded that the training methods used are still conventional and not programmed properly, especially physical exercises such as endurance, reaction speed, strength, and others. Practice is pacAd in the moments leading up to the match. This is not in accordance with the principles of practice. Achievements are instant and won't last for a long time. A habit that often occurs in almost all taekwondo clubs in North Sumatra.

Achieving optimal performance cannot be separated from the role of the coach who designs an exercise for the success of his athletes. A coach only demands maximum results from an athlete so he often forgets things that support an athlete's results (Asmawi & Wiguna, 2015; Ouergui et al., 2020). A taekwondo athlete must have kick speed and agility when competing this is because taekwondo is an unarmed fighting technique for self-defense that involves the application of skilled techniques including punching; jump kick, block, dodge, and parry action with hands and feet (Singh et al., 2018).

Responding to these conditions, it is necessary to design an appropriate training program to support the improvement of kick speed and agility abilities in athletes. The many types of exercises to increase speed and agility are the basis for determining the right training given to junior taekwondo athletes. SAQ stands for Speed, Agility, and Quickness or a form of exercise that can develop speed, agility, and reaction simultaneously (Akhmad & Hasibuan, 2020). Speed is defined as the ability of biomotor experts to move from one point to another in a straight line quickly. Agility means the ability to move from one place to another changing direction quickly. Quikness is characterized by the response given by the body to stimuli from outside the body (Akhmad, 2013). Based on the description above, especially the difficulty of the coach in increasing the kick speed and agility of junior athletes, it is necessary to do research as a solution. Several studies on the effect of SAQ training on speed and agility have been carried out whose results have a significant effect (Azmi & Kusnani, 2018; Fauzi et al., 2020).

Relevant research conducted under the title Effect of Exercise Program Speed, Agility, and Quickness (SAQ) in Improving Speed, Agility, and Acceleration (Azmi & Kusnanik, 2018). In this study, the method used is experimental with a pre-test-posttest design. Posttest is performed only once after manipulation of SAQ exercise for 8 weeks. The experiment is carried out on 26 athletes who are divided into two groups, each group consisting of 13 samples. The method of implementing the SAQ exercise is separate by completing

each post of 3 sets and then moving to another post, and so on until up to 8 posts. Other studies that are relevant to this research are Fauzi et al., (2020) with the title The Effect of HIIT and SAQ Exercises on Agility and Speed. This study uses an experimental method by comparing HIIT exercises with SAQ exercises with a pre-test - posttest design that is carried out once. In addition, the implementation of the exercise with a sample of 30 divided into 2 experimental groups using the block method. After completing 16 experiments, a final test is carried out to see the effect of training on increasing speed and agility.

There is a uniqueness in this research that the implementation of the research is carried out with a circuit system with the implementation consisting of 8 posts. This means that the difference between this study and several previous studies lies in the implementation of the experiments carried out in a circuit system. In addition, this research method was also carried out differently from the previous research method, where the experimental method is carried out through 3 series with 3 post-tests measured every 4 weeks whose results are known for each series and have different improvements.

The above phenomena and solutions are thought to be able to help solve the problem of the coach's difficulties in increasing the kick speed and agility of junior tekwondo athletes. At the same time, this study aims to determine the effect of circuit SAQ training on kick speed and agility of junior taekwondo athletes.

SAQ is a progressive training and instruction system aims at developing basic motor skills to improve the ability of players/athletes to become more skilled faster and with higher precision (Brown & Ferrigno, 2014). SAQ training plays a very important role in motor coordination, acceleration, balance, agility, and reaction development at all stages and at all levels (Velmurugan & Palanisamy, 2011).

Giving SAQ training is an appropriate action to support the results of the achievements to be achieved in athletes who dominate the components of movement speed and agility (Azmi & Kusnanik, 2018; Milanović et al., 2013; Shapie & Rohizam, 2018; Jovanovic et al., 2011). Exercises that involve speed, agility, and speed are training methods that aim to develop motor skills and control of body movements through the development of the neuromuscular system with SAQ exercises that can increase kick speed and agility for junior athletes in taekwondo club Sibayak (Polman et al., 2009; Siramaneerat & Chaowilai, 2020; Malempati, Bujjibabu, & Johnson, 2012).

## METHOD

The type of research used is an experimental method with an equivalent time series design research design. The population of this study is 28 junior athletes at the Sibayak taekwondo club located in Medan, North Sumatra. The sampling technique uses purposive random sampling. There are several considerations in determining the sample size including; the total population aged 15-17 years. The results obtained as many as 24 athletes. Next, simple random sampling is conducted by setting a sample size of 20 people.

This study is conducted on 20 junior taekwondo athletes through repeated time-lapse studies in two different groups with the following sample characteristics: (1) age  $X = 17.85 \pm SD = 0.84$  years; weight  $X = 64.17 \pm SD = 5.36$  kg; height  $X = 66.41 \pm SD = 5.14$  cm. This research is carried out for 6 weeks with a frequency of 3 times in 1 week and consisted of 3 series (Singh et al., 2018). Every 2 weeks a post-test is carried out by design; (1) pre-test-treatment-post-test stage 1, and (2) pre-test-post-test stage 2. From the effect of SAQ training on each exercise series on increasing agility and speed will be seen in each series. This research is carried out from October to December 2020. Considering that it is still the Covid-19 period, the exercises are carried out by implementing health protocols, namely; (1) wearing a mask when close together, (2) trying to Aep a minimum distance of 1.5 meters, and (3) before and after the practice of washing hands with the hand sanitizer that has been prepared. The research design is as follows:

Table 1. Research Design

Pre test	Treatment	Post test
O <sub>1</sub>	X <sub>1</sub>	O <sub>2</sub>
O <sub>2</sub> /O <sub>3</sub>	X <sub>2</sub>	O <sub>4</sub>
O <sub>4</sub> /O <sub>5</sub>	X <sub>3</sub>	O <sub>6</sub>

Note: O<sub>1</sub>, O<sub>3</sub>, O<sub>5</sub> = pre test

X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> = SAQ training (treatment)

O<sub>2</sub>, O<sub>4</sub>, O<sub>6</sub> = post test

Research subjects conduct a pre-test as an O1 value and then are given the SAQ exercise program treatment in 1 treatment group. After 6 exercises, all of them conduct the first post-test series O2/O3. Followed by the second series of treatment with the number of meetings 6 times and end with the post test as the O4/O5 value. The exercise is continued for 6 meetings and the post test is scored as O6. The exercise is carried out with a frequency of 3 times in 1 week. Test instruments in this study: (1) agility test using a 4 x 10 meter shuttle run test (Bushman, 2017), and (2) reaction test kit (Baskoro et al., 2020). The 4 x 10 m shuttle run test is a test to measure the athlete's agility. The implementation of athletes is divided into 4 groups of 5 people each. The score obtained is the time stated on the stop watch in seconds. This test is chosen according to the purpose of the agility test with a field area equivalent to the type of test and the reaction kick test is a test tool to measure kick speed in martial athletes. With the reason that this research is an implementation of the research on the development of the reaction time test that the researcher conducts. In the implementation, each athlete performs the test in turn with the foot on the pedestal button and then the athlete performs a kick by passing the detection sensor that has been adjusted to the kick distance. The score obtained from the implementation of the test is the time indicated on the reactions kick application. The data analysis technique used in this research is the Social Sciences Statistics Package (version 13.0, SPSS). Prior to analysis, normality test (Kolmogorov-Smirnov) and homogeneity test (Levene) are performed with a significant level of  $p < 0.05$ .

## RESULTS AND DISCUSSION

The data obtained from the results of tests and measurements are analyzed using statistical descriptions and the average scores of the results of Kick Speed (KS) and Agility (AG). The data scores in this study can be described in table 2 below.

Table 2. Research Data Description

Test	Variable	Training	Mean $\pm$ SD.	$\alpha = 0.05$	
				lowest score	highest score
Pre tes	KS	NA	0,384 $\pm$ 0,040	0,335	0,460
O <sub>1</sub>	AG		15,27 $\pm$ 0,86	16,54	13,00
O <sub>2</sub>	KS	SAQ	0,382 $\pm$ 0,038	0,335	0,437
	AG		15,02 $\pm$ 0,88	16,38	12,81
O <sub>4</sub>	KS	SAQ	0,353 $\pm$ 0,028	0,301	0,430
	AG		14,63 $\pm$ 0,87	16,00	12,67
O <sub>6</sub>	KS	SAQ	0,283 $\pm$ 0,025	0,260	0,366
	AG		14,29 $\pm$ 0,79	15,72	12,60

In series 1, the average kicking speed is 0.382 $\pm$ 0.038 sec and the score range is 0.335 - 0.437 sec. The effect of SAQ training on agility shows a mean score of 15.02  $\pm$  0.88 s, and a score range of 16.38-12.81 sec. In series 2 the average kicking speed is 0.353 $\pm$ 0.028 sec, and the score range is 0.301 - 0.430. Meanwhile, the average agility score is 14.63  $\pm$  0.87 sec, and the score range from 16.00 - 12.67 sec. In series 3 the average kicking speed is 0.283 $\pm$ 0.025 sec, and the score range is 0.260 - 0.366 sec. While in agility obtained an average of 14.29  $\pm$  0.79 sec, and a score range of 15.72 - 12.60 sec.

Table 3. Percentage Increase in SAQ Training Results in 3 Series

Test	Variables	Training	Percentage (%)
Pre test - O <sub>1</sub>	KS	SAQ	0,424
	AG		0,73
O <sub>1</sub> - O <sub>2</sub> /O <sub>3</sub>	KS	SAQ	0,367
	AG		1,13
O <sub>3</sub> - O <sub>4</sub>	KS	SAQ	0,260
	AG		0,97

The percentage increase from the pre-test of Serie 1 with kick speed is 0.424% while agility increased by 0.73%. The increase in kick speed of the series 2 represents a figure of 0.367% while the increase in agility is



1.13%. The increase in kick speed in the 3 series represents a figure of 0.260% while the increase in agility in the score is 0.97%.

**Table 4. Significance**

Test	Variable	Training	$\alpha = 0.05$	Note
Pre test - O <sub>1</sub>	KS	SAQ	9,424	Sig.
	AG		9,433	Sig.
O <sub>1</sub> - O <sub>2</sub> /O <sub>3</sub>	KS	SAQ	8,393	Sig.
	AG		9,124	Sig.
O <sub>3</sub> - O <sub>4</sub>	KS	SAQ	14,388	Sig.
	AG		15,796	Sig.

In series 1, the t-level speed training is 9,424 and agility is 9,433 with the speed  $\alpha = 0.05$ . This means that there is a significant effect between SAQ training on the speed and agility of Junior Taekwondo athletes. In series 2, the speed training level t is 8,393 and agility is 9,124 with speed  $\alpha = 0.05$ . This means that there is a significant effect between SAQ training on the speed and agility of Junior Taekwondo athletes. In series 3 exercise the t level is 14,388 and agility is 15,796 with a significant level  $\alpha = 0.05$ . This means that there is a significant effect between SAQ training on the speed and agility of Junior Taekwondo athletes.

This study examines the effect of SAQ training on kick speed and agility. SAQ exercise is an exercise that can develop various aspects of motion such as speed, balance, agility, quickness power, coordination, and perceptual balance (Diswar et al., 2016; Nageswaran, 2013). SAQ exercises can be done in a variety of ways that are tailored to the needs of the sport. In taekwondo martial arts, the speed required is kicking speed. Agility is needed when changing body position and changing body direction quickly and precisely.

The purpose of this study is to determine the level of influence of SAQ training on kick speed and agility in junior taekwondo Sibayak club athletes (Akhmad et al., 2019; Milanović et al., 2013). The results of the research in series 1 is from the speed variable at the t-count level of 9.424 and agility of 9.433 with a significant level of  $\alpha = 0.05$ . It means that there is a significant effect between SAQ training on kick speed and agility of the junior taekwondo Sibayak club athletes. The increase in pretest-posttest kick speed increased 0.424% while agility increased 0.73%. If you see the percentage increase is relatively low. The findings of this study can explain to the reader that the exercise performed for 6 times has a relatively low increase. This means that 6 times SAQ training is still not enough to increase kick speed and agility. However, there is an increase between the pretest-posttest series 1.

In series 2 of speed training, the t-count is 8.393 and agility is 9.124 with a significant level of  $\alpha = 0.05$ . It means that there is a significant effect between SAQ training on kick speed and agility of the junior taekwondo sibayak club athletes. The pretest-posttest increase in kick speed increased 0.36% while agility increased 1.13%. There was also an increase in series 2, only a lower increase than series 1 in the variable kick speed (0.424% – 0.36%). There was also an increase in agility and relatively higher than series 1 (0.73%-1.135%). However, there is still an increase between the pretest-posttest series 2. The findings of this study can explain to the reader that the exercise carried out for 12 times also has a relatively low increase. In total, the percentage increase in the kick speed variable shows a percentage of 0.78% while the agility variable shows 1.86%. This means that 12 times SAQ training is still not enough to increase kick speed and agility.

In series 3, the t-count speed exercise is 14,388 and agility is 15,796 with a significant level of  $\alpha = 0.05$ . This means that there is a significant effect between SAQ training on kick speed and agility of the junior taekwondo Sibayak club athletes. The pretest-posttest increase in kick speed increased 0.27% while agility increases 0.97%. There is also an increase in series 2, only a lower increase than series 2 in the variable kick speed (0.36% – 0.27%). There is a decrease in the agility variable (1.135%-0.97%). However, there is still an increase in the effect between the pretest-posttest series 3. The findings of this study can explain to the reader that the exercise performed for 18 times has a relatively low increase. In total, the percentage increase in the kick speed variable shows a percentage of 1.05% while the agility variable shows 2.83%. This means that the SAQ exercise 18 times has shown an increase in kick speed and agility (Fox, 1992).

Partially or in the form of a series, it shows a percentage increase in each series despite fluctuations in the increase in each series, both kick speed and agility. Exercise 6 and 12 times can not guarantee the achievement of optimal performance because the percentage of improvement is still low. So it can be ensured that continuous SAQ training with a planned program will increase speed and agility, including junior taekwondo athletes (Sporis et al., 2010). The results of this study can be used as a basis for determining that Speed, Agility, and Quickness (SAQ) exercises can increase kick speed and agility (Cherappurath & Elayeraja, 2017). Exercise with 6 and 12 sessions does not guarantee the achievement of the desired results, so it takes a longer time, namely 18 training sessions.

## CONCLUSION

SAQ exercises that are carried out continuously can increase kick speed and agility for junior taekwondo athletes. However, the study has several limitations including; (1) the implementation of research is still during the Covid-19 period, so that the exercise is limited by implementing health protocols such as; (a) wearing a mask when close together, (b) trying to maintain a minimum distance of 1.5 meters, and (c) before and after practice washing hands with hand sanitizer that has been prepared; (2) the research is limited to the junior athletes of the Sibayak taekwondo club with a limited sample of 20 athletes. So it is recommended for other researchers to be able to conduct similar research with a larger number of samples; and (3) because this type of research is a quasi-experimental where the sample is not placed centrally so that it is difficult to control nutritional patterns, rest patterns and exercise complaints.

The results of the study conclude that there is a change in the increase as indicated by the percentage value through 4 stages of the test, namely pre-test, post-test series 1, post-test series 2, and post-test series 3. The results of this study are indicated by changes in kick speed and agility after 18 training meetings. This change is the basis that programmed SAQ exercises will increase speed and agility for junior taekwondo athletes and do not rule out the possibility to be carried out by other sports athletes who in these sports activities require dominating speed and agility. It is recommended to coaches in taekwondo in particular and other sports in general if you want to improve kick speed and agility, you can use the SAQ circuit system programmatically.

## REFERENCES

- Akhmad, I. (2013). *Dasar-Dasar Materi Fisik Olahragawan* (1st ed.). Medan: Unimed Press.
- Akhmad, I., & Hasibuan, B. S. (2020). *Contribution of SAQ Exercises and Plyometric Exercises Against Smash in Princess Volleyball Games*. 23(UniCoSS 2019), 201–204.
- Akhmad, I., Supriadi, A., Dewi, R., & Swara, Y. (2019). The Influence of SAQ Training on Speed and Agility for Futsal Young Athletes on X-Trail 14 Futsal Academy. *International Journal of Science and Research*, 8(12), 933–936. <https://doi.org/10.21275/ART20203413>
- Baechle, T. R., & Earle, R. W. (2000). *Essentials of Strength Training and Conditioning* (2nd ed.). Champaign, IL: Human Kinetics.
- Brown, L. E., & Ferrigno, V. A. (2005). *Training for Speed, Agility, and Quickness* (2nd ed.). Champaign, IL: Human Kinetics.
- Brown, L. E., & Ferrigno, V. A. (2014). *Training for Speed, Agility & Quickness* (3rd ed.). Champaign, IL: Human Kinetics.
- Cherappurath, N., & Elayeraja, M. (2017). Effects of Speed, Agility and Quickness (SAQ) Training on Anaerobic Endurance and flexibility of Novice Tennis Players. *European Journal of Physical Education and Sport Science*, 3(11), 165–172. <https://doi.org/10.5281/zenodo.1119118>

- Asmawi, M., & Wiguna, I. B. (2015). the Effect of Training Method and Leg Power Toward Dolyo Chagi Ability. *Jipes - Journal of Indonesian Physical Education and Sport*, 1(2), 56. <https://doi.org/10.21009/jies.012.06>
- Azmi, K., & Kusnanik, N. W. (2018). Effect of Exercise Program Speed, Agility, and Quickness (SAQ) in Improving Speed, Agility, and Acceleration. *Journal of Physics: Conference Series*, 947(1), 012043. <https://doi.org/10.1088/1742-6596/947/1/012043/meta>
- Baskoro, W. C., Akhmad, I., & Simatupang, N. (2020). *Agility Side Step Test Development Test Device Motion Sensor Based*. 23(December 2019), 23–24. <https://doi.org/10.2991/ahsr.k.200305.001>
- Bompa, T. O., & Haff, G. G. (2009). Periodization: Theory and Methodology of Training. In *Champaign, Ill. : Human Kinetics*;
- Bushman, B. A. (2017). *Complate Guide Fitness & Health* (2nd ed.). Champaign, IL.: Human Kinetics.
- Diswar, S. K., Choudhary, S., & Mitra, S. (2016). Comparative effect of SAQ and circuit training programme on selected physical fitness variables of school level basAtball players. *International Journal of Physical Education, Sports, and Health*, 3(5), 247–250.
- Fauzi, M., Wiriawan, O., & Khamidi, A. (2020). Pengaruh Latihan HIIT dan SAQ Terhadap Alincahan dan Acepatan. *Multilateral Jurnal Pendidikan Jasmani dan Olahraga*, 19(2), 146. <https://doi.org/10.20527/multilateral.v19i2.8910>
- Fong, S. S. M., Ng, S. S. M., & Chung, L. M. Y. (2013). Health through martial arts training: Physical fitness and reaction time in adolescent Taekwondo practitioners. *Health*, 5(6), 1–5. <https://doi.org/10.4236/health.2013.56a3001>
- Fox, E. (1992). *Sports Physiology (Cloth Verison) The Cheap Fast Free Post*. McGraw-Hill Education - Europe.
- Jeong, H. S., Ha, S., Jeong, D. H., O'sullivan, D. M., & Lee, S. Y. (2021). Injury and illness in world taekwondo junior athletes: An epidemiological study. *International Journal of Environmental Research and Public Health*, 18(4), 1–11. <https://doi.org/10.3390/ijerph18042134>
- Jovanovic, M., Sporis, G., Omrcen, D., & Fiorentini, F. (2011). Effects of speed, agility, quickness training method on power performance in elite soccer players. *Journal of Strength and Conditioning Research*, 25(5), 1285–1292. <https://doi.org/10.1519/JSC.0b013e3181d67c65>
- Malempati, B., & Johnson, P. (2012). Effect of plyometric and speed agility and quickness SAQ training on selected physiological and physical fitness attributes of male handball players. *Internasional Journal of Health, Physical Education and Computer Science in Sports*, 8, 21–25. <http://hdl.handle.net/10603/39049>
- Milanović, Z., Sporiš, G., Trajković, N., James, N., & Šamija, K. (2013). Effects of a 12 week SAQ training programme on agility with and without the ball among young soccer players. *Journal of Sports Science and Medicine*, 12(1), 97–103.

- Shapie, M. N. M., & Rohizam, R. N. F. R. (2018). A Case Study: The Effects of Speed, Agility and Quickness (SAQ) Training Program on Hand-Eye Coordination and Dynamic Balance among Children. *Journal of Physical Fitness, Medicine & Treatment in Sports*, 2(4), 1–6. <https://doi.org/10.19080/jpfmts.2018.02.555591>
- Nageswaran, D. A. S. (2013). Effect of SAQ Training on Speed Agility and Balance Among Inter Collegiate Athletes. *International Journal of Scientific Research*, 2(1), 1–2. <https://doi.org/10.15373/22778179/jan2013/84>
- Ouergui, I., Messaoudi, H., Chtourou, H., Wagner, M. O., Bouassida, A., Bouhlel, E., Franchini, E., & Engel, F. A. (2020). Repeated sprint training vs. Repeated high-intensity technique training in adolescent taekwondo athletes—a randomized controlled trial. *International Journal of Environmental Research and Public Health*, 17(12), 1–14. <https://doi.org/10.3390/ijerph17124506>
- Polman, R., Bloomfield, J., & Edwards, A. (2009). Effects of SAQ training and small-sided games on neuromuscular functioning in untrained subjects. *International Journal of Sports Physiology and Performance*, 4(4), 494–505. <https://doi.org/10.1123/ijsp.4.4.494>
- Sabatini, N. K. G., Nugraha, M. H. S., Dewi, A. A. N. T. N. (2019). FaKSor-FaKSor Yang Mempengaruhi Acepatan, Akuatan, dan Daya Ledak Terhadap Tendangan Pada Atlet Taekwondo. *Jurnal Pendidikan Olahraga*, 8(2), 85–95. <https://doi.org/10.31571/jpo.v8i2.1120>
- Singh, A., Sathe, A., & Sandhu, J. (2018). Effect of a 6-Week agility training program on spatiotemporal parameters in gait cycle of Indian taekwondo players. *Indian Journal of Physiotherapy and Occupational Therapy - An International Journal*, 12(4), 6-13. <https://doi.org/10.5958/0973-5674.2018.00071.0>
- Siramaneerat, I., & Chaowilai, C. (2020). Impact of specialized physical training programs on physical fitness in athletes. *Journal of Human Sport and Exercise*, 17(2), 1–11. <https://doi.org/10.14198/jhse.2022.172.18>
- Sporis, G., Jukic, I., Milanovic, L., & Vucetic, V. (2010). Reliability and factorial validity of agility test for soccer players. *Journal of Strength and Conditioning Research*, 24(3), 679–686.
- Velmurugan, G., & Palanisamy, A. (2011). Effects of Saq Training and Plyometric Training on Speed Among College Men Kabaddi Players. *Indian Journal of Applied Research*, 3(11), 432–433. <https://doi.org/10.15373/2249555x/nov2013/138>